

This Listing of Claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

Claim 1 (currently amended): A process for the production of ethyl acetate which comprises:

- (a) converting a C₂ feedstock comprising ethanol to ethyl acetate in an ethyl acetate production zone by a procedure selected from:
 - (i) dehydrogenation, and
 - (ii) reaction with acetaldehyde
- (b) recovering from the ethyl acetate production zone an intermediate reaction product mixture comprising hydrogen and liquefiable products comprising the majority of the ethyl acetate produced in step (a), ethanol, and by-products containing reactive carbonyl groups;
- (c) passing at least a portion of the liquefiable products of the intermediate reaction product mixture as recovered from the ethyl acetate production zone to a selective hydrogenation zone and contacting ~~at least a portion of~~ the liquefiable products of the intermediate reaction product mixture with a selective hydrogenation catalyst in the presence of hydrogen in [a] the selective hydrogenation zone maintained under selective hydrogenation conditions effective to selectively hydrogenate said by-products containing reactive carbonyl groups to corresponding alcohols;
- (d) recovering from the selective hydrogenation zone a selectively hydrogenated reaction product mixture comprising ethyl acetate, ethanol, hydrogen and hydrogenated by-products comprising said corresponding alcohols;
- (e) distilling the selectively hydrogenated reaction product mixture in one or more distillation zones so as to produce a

first composition comprising substantially pure ethyl acetate and a second composition comprising ethanol and water;

(f) treating the second composition of step (e) to separate water therefrom and yield a third composition comprising ethanol with a reduced water content; and

(g) recovering the third composition of step (f).

Claim 2 (original): A process according to claim 1, wherein in step (a) the C_2 feedstock is converted to ethyl acetate by a dehydrogenation procedure which comprises contacting a vaporous mixture containing ethanol and hydrogen with a dehydrogenation catalyst in a dehydrogenation zone maintained under dehydrogenation conditions effective for dehydrogenation of ethanol to yield ethyl acetate.

Claim 3 (previously presented): A process according to claim 2, wherein the ethanol:hydrogen molar ratio in the dehydrogenation zone is from about 1:10 to about 1000:1, the combined partial pressure of ethanol and hydrogen in the dehydrogenation zone is from about 3 bar (3×10^5 Pa) up to about 50 bar (5×10^6 Pa), and the temperature in the dehydrogenation zone is from about 100°C to about 260°C.

Claim 4 (previously presented): A process according to claim 3, wherein the combined partial pressure of ethanol and hydrogen in the dehydrogenation zone is at least about 6 bar (6×10^5 Pa) up to about 30 bar (3×10^6 Pa).

Claim 5 (previously presented): A process according to claim 2, wherein the dehydrogenation catalyst is a copper containing catalyst which comprises, before reduction, copper oxide on alumina.

Claim 6 (previously presented): A process according to claim 2, wherein the rate of supply of the C_2 feedstock to the dehydrogenation zone corresponds to an ethanol liquid hourly space velocity (LHSV) of from about 0.5 hr^{-1} to about 1.0 hr^{-1} .

Claim 7 (previously presented): A process according to claim 1, wherein the selective hydrogenation conditions in the selective hydrogenation zone of step (c) include a reaction product mixture:hydrogen molar ratio of from about 1000:1 to about 1:1, a combined partial pressure of the liquefiable products of the intermediate reaction product mixture and hydrogen of from about 5 bar ($5 \times 10^5 \text{ Pa}$) to about 80 bar ($8 \times 10^6 \text{ Pa}$), and a temperature in the range of from about 20°C to about 160°C .

Claim 8 (previously presented): A process according to claim 1, wherein the combined partial pressure of the liquefiable products of the intermediate reaction product mixture and hydrogen in step (c) is from about 25 bar ($2.5 \times 10^6 \text{ Pa}$) to about 50 bar ($5 \times 10^6 \text{ Pa}$).

Claim 9 (previously presented): A process according to claim 1, wherein the selective hydrogenation catalyst comprises a metal selected from nickel, palladium, platinum, ruthenium, rhodium and rhenium.

Claim 10 (previously presented): A process according to claim 9, wherein the catalyst comprises ruthenium on carbon.

Claim 11 (previously presented): A process according to claim 1, wherein the rate of supply of liquefiable liquid products of the intermediate reaction product mixture to the selective hydrogenation zone corresponds to a liquid hourly space velocity (LHSV) of from about 0.5 hr^{-1} to about 2.0 hr^{-1} .

Claim 12 (previously presented): A process according to claim 1, wherein step (e) comprises supplying the selectively hydrogenated reaction product mixture to a first distillation zone maintained under distillation conditions effective for distillation therefrom of a first distillate comprising ethanol, water and ethyl acetate, recovering a first distillate comprising ethanol, water and ethyl acetate from the first distillation zone and a bottom product comprising ethanol and water, supplying the first distillate to a second distillation zone maintained under distillation conditions effective for distillation therefrom of a second distillate comprising ethanol, water, and ethyl acetate and so as to yield a substantially pure ethyl acetate bottom product, and recovering a substantially pure ethyl acetate bottom product from the second distillation zone.

Claim 13 (previously presented): A process according to claim 12, wherein the first distillation zone is operated at a pressure of less than about 4 bar (4×10^5 Pa).

Claim 14 (previously presented): A process according to claim 12, wherein the first distillation zone is operated at a pressure of from about 1 bar (10^5 Pa) to about 2 bar (2×10^5 Pa).

Claim 15 (previously presented): A process according to claim 12, wherein the second distillation zone is operated at a pressure of from about 4 bar (4×10^5 Pa) to about 25 bar (2.5×10^6 Pa).

Claim 16 (previously presented): A process according to claim 12, wherein the second distillation zone is operated at a pressure of from about 9 bar (9×10^5 Pa) to about 15 bar (1.5×10^6 Pa).

Claim 17 (previously presented): A process according to claim 12, wherein the first distillate contains less than about 10 mol % water.

Claim 18 (previously presented): A process according to claim 12, wherein an ethanol rich stream containing substantially all of the water in the selectively hydrogenated reaction product mixture is recovered from the bottom of the first distillation zone, while an overhead stream that contains light components having lower boiling points than ethyl acetate and its azeotropes with water and ethanol present in the selectively hydrogenated reaction product mixture is recovered from the first distillation zone, and in which the first distillate comprises a liquid draw stream which is recovered from an upper region of the first distillation zone and which comprises ethyl acetate, ethanol, water and minor amounts of other components.

Claim 19 (previously presented): A process according to claim 18, wherein the liquid draw stream contains from about 40 mol % to about 55 mol % ethyl acetate, from about 1 mol % to about 6 mol % water, not more than about 1 mol % other components, and the balance ethanol.

Claim 20 (previously presented): A process according to claim 19, wherein the liquid draw stream contains about 45 mol % ethyl acetate, about 50 mol % ethanol, about 4 mol % water and about 1 mol % other components.

Claim 21 (previously presented): A process according to claim 18, wherein the liquid draw stream is passed to the second distillation zone which is operated at a pressure of from about 4 bar (4×10^5 Pa) absolute to about 25 bar (2.5×10^6 Pa) absolute.

Claim 22 (previously presented): A process according to claim 21, wherein the bottom product from the second distillation zone contains from about 99.8 mol % to about 99.95 mol % ethyl acetate.

Claim 23 (previously presented): A process according to claim 20, wherein the second distillate comprises the overhead stream from the second distillation zone and is returned to the first distillation zone.

Claim 24 (previously presented): A process according to claim 23, wherein the overhead stream from the second distillation zone contains about 25 mol % ethyl acetate, about 68 mol % ethanol, about 6 mol % water, and about 1 mol % of other components.

Claim 25 (previously presented): A process according to claim 23, wherein the overhead stream from the second distillation zone is returned to the first distillation zone at a point above the feed point of the liquefiable products of the selectively hydrogenated reaction product mixture.

Claim 26 (previously presented): A process according to claim 18, wherein in step (f) the ethanol rich stream recovered from the bottom of the first distillation zone is subjected to treatment for the removal of water therefrom thereby to produce a relatively dry ethanol stream suitable for recycle to step (a).

Claim 27 (previously presented): A process according to claim 1, wherein the relatively dry ethanol stream of step (f) is recycled to step (a).

Claim 28 (previously presented): A process according to claim 1, wherein step (e) comprises extractive distillation with an extractive agent comprising polyethylene glycol and dipropylene glycol, diethylene glycol, or triethylene glycol.

Claim 29 (previously presented): A process according to claim 1, wherein step (e) comprises extractive distillation in the presence of an extractive agent containing dimethyl sulphoxide.